

Measures of Overfishing Based on MSY

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We can't conduct management at the ecosystem level without also managing simultaneously at other levels: we cannot give up management at the level of the individual species and we have to include the biosphere. Furthermore, management at each level must be consistent with management at the other levels. This can be done by managing human enterprise to fall within empirically observed normal ranges of natural variation. For example, human influence can be guided by the limits observed in: 1) the ways other species interact with, and influence each other, 2) the ways other species interact with, and influence, ecosystems and 3) the ways other species interact with, and influence, the biosphere. Doing so avoids singular focus and over- (or under-) emphasis on factors being taken into account. Systemic management based on empirical information requires focus on each element of the spectrum of specific management questions while taking into account the suite of relevant factors in proportion to their relative importance. Thus, systemic management overcomes the inadequacies of conventional approaches. Among such approaches are those derived from the concept of maximum sustainable yield (MSY) for managing fisheries. Empirical information also allows for an

appraisal of just how misleading conventional approaches have been.

Thus, overfishing can be measured through applying current management principles to demonstrate the problems of conventional management. The mortality rates caused by fishing on individual resource species has been on the order of 15 to 700-fold greater than the mean of predation rates on these same prey species by consumer species other than humans. There is a 20 to 300-fold greater consumption rate by fisheries harvesting groups of species, such as finfish in the Bering sea, compared to the mean of consumption from such groups by non-human species. Similar comparisons at the ecosystem level show that fishing is extracting biomass from various ecosystems at rates that are 20 to over 2000-fold more than the biomass that is consumed in these systems, on the average, by other consumer species. At the level of the entire marine environment, fisheries are harvesting biomass at rates that are almost four orders of magnitude larger than the biomass that is consumed by other species. The collective effects of fishing at these magnitudes have contributed to recent changes observed in marine ecosystems.

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